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Lepidoptera composition variation in riparian forests in the South of Brazil

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ABSTRACT

This study was performed as a contribution to the knowledge of Lepidoptera of Western Santa Catarina State, south of Brazil and its composition variation in riparian forests. The species list is a result of independent sampling conducted during the years of 2012, 2014 and 2015. Seventy-six different species of Lepidoptera were sampled in the riparian forest of Peixe's River. Lepidoptera similarity between sampled areas was low and this result may indicate heterogeneity in species composition along the riparian forests. It should be highlighted that more knowledge about river basins in Brazil is necessary, due to this heterogeneity that results of rapid variation in species composition along environmental gradients, as riparian forests.

Keywords: butterflies; seasonal deciduous forest; species inventory; subtropical region.

Variação na composição de Lepidoptera em matas ciliares no Sul do Brasil

RESUMO

Esse estudo foi realizado como uma contribuição ao conhecimento sobre Lepidoptera no oeste do estado de santa Catarina, sul do Brasil e sua variação na composição de espécies em matas ciliares. A lista de espécies é resultado de amostragens independentes realizadas durante os anos de 2012, 2014 e 2015. Foram registradas 76 espécies de Lepidoptera nas matas ciliares do rio do Peixe. A similaridade na composição de espécies entre as áreas foi baixa e esse resultado pode indicar certa heterogeneidade ao longo das matas ciliares. Com isto fica evidenciado que são necessárias mais informações sobre bacia hidrográficas no Brasil, devido a esta heterogeneidade poder resultar de rápidas variações na composição de espécies ao longo de gradientes ambientais, como florestas ciliares.

Palavras-chave: borboletas, floresta estacional decidual, inventário, região subtropical.

Introduction

All over the world 156,000 Lepidoptera species have been found (HEPPNER, 2008). Only in Neotropics around 46,000 species are known (HEPPNER, 1997), with near 26,000 species known in Brazil (DUARTE et al., 2012). Many recent researches in Santa Catarina State have been contributing to the understanding of Lepidoptera richness. These works includes publications about coastal areas and in up-country areas (CARNEIRO et al., 2008; SCHMIDT et al., 2012; FAVRETTO, 2012; FAVRETTO; SANTOS, 2014; FAVRETTO; SANTOS, 2017). It also covers some more extensive researches involving several municipalities (SIEWERT et al., 2010a; SIEWERT et al., 2010b; FERRO et al., 2012; FAVRETTO et al., 2013a; PIOVESAN et al., 2014; SILVA; SILVA, 2014; FAVRETTO et al., 2015; ORLANDIN et al., 2016).

Peixe's River is located in Western Santa Catarina State, its springhead is in the municipality of Calmon and it covers 290 km until the outfall in Uruguai River. Several urban areas are near its riparian forests and, in many places, the vegetation were historically suppressed during São Paulo - Rio Grande railway construction (GUZZI, 2008). Despite several researches has been performed in low Peixe's River riparian forests (SEGALIN, 2008; FAVRETTO; GUZZI, 2008; SPIER; GUZZI, 2008; ZAGO; GUZZI, 2008; ONGHERO-JR., 2008; GUZZI et al., 2012), there are few studies involving insects in these areas. To the best of our knowledge, there is just one study on Lepidoptera (FAVRETTO; SANTOS, 2014).

Worrying fact, considering that, when preserved, riparian forests are important areas for the maintenance of Lepidoptera population, and anthropic modifications in these areas can change essential microhabitats of this faunistic group (CABETTE et al., 2017). Especially considering the influences of forest composition and variation of flowering periods over Lepidoptera community structure. These factors, associated with isolation and fragmentation level of forest areas, result in regional variation of species composition of Lepidoptera (STEFFAN-DEWENTER et al., 2000; STONER; JOERN, 2004).

Thus, this paper presents a Lepidoptera survey in four sampling areas of low Peixe's River riparian forests, in Brazil these forest are areas legally protected for environmental conservation, known as permanent preservation areas. We also discuss the frequency of occurrence of Lepidoptera and the variation of species composition between the areas, and the possible role of Lepidoptera as environmental quality bioindicators in sampled forests.

Materials and Methods

Lepidoptera survey was conducted in Peixe's River riparian forests (permanent preservation areas) in four areas distributed in the municipalities of Lacerdópolis, Erval Velho, Ouro, Capinzal, Piratuba and Ipira, in Western Santa Catarina State, south of Brazil. These riparian forests are composed of small forest remnants of permanent preservation areas, connected to larger remnants in some parts, and surrounded by agriculture areas. The phytophysiognomy is characterized as Seasonal Deciduous Forest and varies along the river basin (from south to north) to Mixed Ombrophilous Forest (VIBRANS et al., 2012).

Sampling was conducted along two or three days in each area. The process included entomological net as well as photographical records, it covered 5 km transects in each side of the river. The sampling months in area A1 were January and March 2015 (27°17'0.19" S, 51°32'41.58" W); Favretto and Santos (2014) data were used for area A2 (27°21'6.29" S, 51°38'46.50" W); January 2014 and March 2015 for area A3 (27°21'52.04" S, 51°41'11.76" W); and January and March 2014 for area A4 (27°22'49.35" S, 51°43'48.51" W). Regarding to species identification the following references were considered: D'Abrera (1981, 1984, 1987a, 1987b, 1988, 1994), Uehara-Prado et al. (2004), Favretto et al. (2013b).

Species frequency of occurrence were calculated, constancy values of Silva et al. (2012) were adapted to the present work considering the following: species present in more than 50% of the samples – very common; between 25% and 49% - common; less than 25% of samples – uncommon. The similarity index of Jaccard between samples areas were applied through the use of the Past software, version 2.16 (HAMMER et al., 2001).

Results and Discussion

Seventy-six species of Lepidoptera in Peixe's River riparian forests were recorded, this are equivalent to 65.21% and 31% more species than those recorded by Favretto et al. (2015) and Favretto (2012), respectively, in the urban area of the municipality of Joaçaba near the sampled areas (Tab. 1). The species richness here were also 217% larger than recorded by Schmidt et al. (2012), in a survey conducted in Western Santa Catarina. However, Carneiro et al. (2008) found a species richness 210% larger in Santa Catarina coast.

Table 1. Lepidoptera species list recorded in Peixe's River riparian forests, Western Santa Catarina State, South Brazil. FO – frequency of occurrence.

Family	Species	A1	A2	A3	A4	FO (%)
HESPERIIDAE	*Lychnuchoides ozias* (Hewitson, 1878)		X			25
	Astraptes sp. (Hübner, 1819)		X			25
	Autocthon cf. *zarex* (Hübner, 1818)		X		X	50
	Pyrgus sp. (Hübner, 1819)		X			25
	Saliana saladin (Evans, 1955)		X			25
	Trina geometrina geometrina (C. Felder; R. Felder, 1867)		X			25
	Urbanus dorantes (Stoll, 1790)		X		X	50
	Urbanus albimargo rica (Evans, 1952)		X			25
NYMPHALIDAE	*Actinote* sp. (Hübner, 1819)		X			25
	Actinote sp. (Hübner, 1819)	X		X	X	75
	Adelpha abia (Hewitson, 1850)		X			25
	Adelpha syma (Godart, 1824)		X			25
	Dione moneta moneta (Hübner, 1825)			X	X	50
	Anartia amathea roeselia (Eschscholtz, 1821)	X	X	X	X	100
	Archaeoprepona sp. (Fruhstorfer, 1915)		X		X	50
	Biblis hyperia nectanabis (Fruhstorfer, 1909)		X	X	X	75
	Caligo illioneus pampeiro (Fruhstorfer, 1904)		X			25
	Caligo martia (Godart, 1824)		X			25
	Chlosyne lacinia saundersi (E. Doubleday, 1847)		X		X	50
	Danaus erippus (Cramer, 1775)		X			25
	Doxocopa laurentia laurentia (Godart, 1824)	X	X	X	X	100
	Dryas iulia alcionea (Cramer, 1779)	X		X	X	75
	Dynamine myrrhina (Doubleday, 1849)		X		X	50
	Dynamine tithia tithia (Hübner, 1823)		X			25
	Epityches eupompe (Geyer, 1832)		X			25
	Hamadryas sp. (Hübne, 1806)	X		X		50
	Hamadryas amphinome (Linnaeus, 1767)		X		X	50
	Hamadryas epinome (C. Felder; R. Felder, 1867)		X			25
	Hamadryas februa (Hübner, 1823)		X			25
	Hamadryas fornax (Hübner, 1823)	X	X	X		75
	Heliconius erato phyllis (Fabricius, 1775)	X	X	X	X	100
	Heliconius ethilla narcaea (Godart, 1819)	X	X			50
	Hypanartia lethe (Fabricius, 1793)	X	X		X	75
	Junonia evarete evarete (Cramer, 1779)			X	X	50
	Marpesia petreus (Cramer, 1776)				X	25
	Mechanitis lysimnia (Fabricius, 1793)		X		X	50
	Memphis moruus stheno (Prittwitz, 1865)	X	X	X	X	75
	Methona themisto (Hübner, 1818)		X			25
	Morpho epistrophus catenaria (Perry, 1811)		X	X	X	100
	Morpho helenor (Cramer, 1776)	X	X	X	X	100
	Myscelia orsis (Drury, 1782)		X	X		50
	Ortilia dicoma (Hewitson, 1864)		X			25
	Ortilia ithra (W.F. Kirby, 1900)		X			25
	Ortilia orthia (Hewitson, 1864)		X			25
	Placidina euryanassa (C. Felder; R. Felder, 1860)	X	X	X	X	25
	Epityches eupompe (Geyer, 1832)		X			25
	Siproeta stelenes (Linnaeus, 1758)		X			25
	Siproeta epaphus trayja (Hübner, 1823)		X	X	X	75
	Tegosa claudina (Eschscholtz, 1821)		X		X	50
PAPILIONIDAE	*Battus polydamas polyadamas* (Linnaeus, 1758)		X			25
	Heraclides anchisiades capys (Hübner, 1809)	X	X		X	75
	Heraclides astyalus astyalus (Godart, 1819)		X	X	X	75
	Heraclides hectorides (Esper, 1794)	X			X	50
	Heraclides thoas brasiliensis (Rothschild; Jordan, 1906)	X	X	X		75
	Mimoides lysithous (Hübner, 1821)		X			25
	Parides agavus (Drury, 1782)			X		25
	Parides bunichus perrhebus (Boisduval, 1836)		X		X	50
	Parides sp. (Hübner, 1819)		X			25
PIERIDAE	*Dismorphia* sp. (Hübner, 1816)		X		X	50
	Eurema sp. (Hübner, 1819)		X		X	50
	Phoebis neocypris neocypris (Hübner, 1823)		X		X	50

Cont.

Cont.

Family	Species	A1	A2	A3	A4	FO (%)
RIODINIDAE	*Caria plutargus* (Fabricius, 1793)	X				25
	Chamaelimnas briola (Bates, 1868)		X			25
	Lasaia agesilas (Latreille, 1809)	X	X			50
	Melanis smithiae (Westwood, 1851)	X	X		X	75
	Riodina lycisca (Hewitson, 1853)	X	X		X	75
	Barbicornis basilis (Godart, 1824)			X		25
EREBIDAE	*Phaloe cruenta* (Hübner, 1823)		X			25
GEOMETRIDAE	*Pantherodes pardalaria* (Hübner, 1823)		X		X	50
NOCTUIDAE	*Ascalapha odorata* (Linnaeus, 1758)		X			25
SATURNIIDAE	*Arsenura* sp. (Duncar; Westwood, 1841)	X				25
	Dirphia sp. (Hübner, 1819)		X			25
	Leucanella sp. (Lemaire, 1969)		X			25
	Molippa sp. (Walker, 1855)		X			25
SPHINGIDAE	*Callionimia* cf. *parce* (Fabricius, 1775)		X			25

The area A2 had the largest richness of the sampled areas (s = 65), that was recorded by Favretto and Santos (2014). The second largest species richness area was A4 (s = 34). Lepidoptera similarity between sampled areas was low indicating heterogeneity in species composition in the sampled riparian forests. Lepidoptera in A1 and A3 areas were more similar to each other (S_j = 0.393). The same was observed for A2 and A4 areas (S_j = 0.394).

The low similarity between different areas may be a result of low connectivity and different phytophysiognomies characteristics between forest remnants (BONFANTTI et al., 2011) because of the relation between Lepidoptera and plant species composition (BONFANTTI et al., 2009; ROSA et al., 2011). Therefore, those factors may be involved in the species heterogeneity between sampled areas noted in this research. It may occur because of the vegetation composition that can also differs along watershed affecting Lepidoptera composition (VIBRANS et al. 2012).

Nymphalidae had the largest species richness (s = 41), followed by Hesperiidae and Papilionidae (s = 9). Most species had a frequency equal or above 50% (s = 39) thus considered as very common in sampled riparian forests. The other species were considered common (s = 37), with 25% of frequency. However, only six species were recorded in all sampled areas and had a frequency of 100% (Fig. 1). These species were from family Nymphalidae: *Anartia amathea roeselia* (Eschscholtz, 1821), *Doxocopa laurentia laurentia* (Godart, 1824), *Heliconius erato phyllis* (Fabricius, 1775), *Morpho epistrophus catenaria* (Perry, 1811), *Morpho helenor* (Cramer, 1776) and *Placidina euryanassa* (C. Felder & R. Felder, 1860).

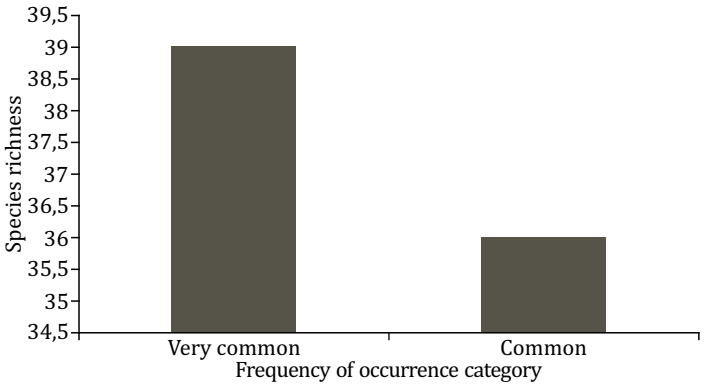

Figure 1. Lepidoptera species frequency of occurrence in Peixe's River riparian forests, Western Santa Catarina State, Southern Brazil.

Nymphalidae with the largest species richness is a pattern found in other researches. Similar results were found by Schmidt et al. (2012) and Favretto et al. (2015) in other areas of Western Santa Catarina State, still with higher richness of Nymphalidae. Considering the entire state of Santa Catarina, Piovesan et al. (2014) recorded Nymphalidae as the third family with the highest species richness. In Rio Grande do Sul State, Marchiori and Romanowski (2006) and Rosa et al. (2011) have also found the largest richness to Nymphalidae, followed by Hesperiidae when researching in areas with riparian forests.

The largest richness in Nymphalidae probably occurred because this family is one of the richest families of diurnal Lepidoptera species in Brazil (DUARTE et al., 2012). Food resources availability in sampled areas can be pointed as another factor which influences Nymphalidae and other families richness. This is related to Lepidoptera species association with certain plant species (FRONZA et al., 2011) resulting in larger species richness in forests with more plant diversity, allowing more food resources to immature and adults of Lepidoptera (WALTZ; COVINGTON, 2004; MARCHIORI; ROMANOWSKI, 2006).

Some researchers have found similar results related to species frequency of occurrence. In the municipality of Joaçaba, Favretto et al. (2015) also found high frequency of *A. amathea roeselia*. Schmidt et al. (2012) found *P. euryanassa* as the most frequent species. Some recorded species are considered environmental quality bioindicators, for instance *Parides agavus* (Drury, 1782) and *Dynamine myrrhina* (Doubleday, 1849) associated with forest environments (MARCHIORI; ROMANOWSKI, 2006; PAZ et al., 2008), and *D. laurentia laurentia* (Godart, 1824) and *Mechanitis lysimnia* (Fabricius, 1793) with riparian forests (ROSA et al., 2011).

It is worth noting that when different studies are compared, floristic composition peculiarities, abiotic factor, and sampling effort may influence the results (PAZ et al., 2008). However, species survey with short sample time may produce important results of forest conservation quality and help to track future environmental improvements (ISEHARD et al., 2010; MAJUMDER et al., 2012). Therefo-re, this riparian forest research in permanent preservation areas can contribute to evaluate possible changes in these areas over time and understand the variation of Lepidoptera species in legally protected forests and river basins of Brazil.

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